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Forest Pest Management Report

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ANNUAL SOUTHWESTERN REGION PEST CONDITIONS REPORT 1991

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APRIL 1992

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FOREWARD

The status of major insects and diseases in Southwestern forests in 1991 is summarized in this report. Much of the information is based on aerial and ground surveys conducted by Forest Pest Management Specialists, Southwestern Region, and State Pest Management Specialists of the Division of Forestry, Arizona State Land Department, and the New Mexico Department of Agriculture. These surveys report short-term changes in pest activity, as well as indicating long-term trends when compared to previous surveys.

As in the past, Forest Pest Management Specialists have compiled the information for lands of all ownerships; if required, further information and additional copies of this publication are available upon request.

ACKNOWLEDGEMENTS

We thank Robert Cain, Extension Forest Entomologist, New Mexico State University Cooperative Extension Service; and Robert Celaya, Forest Pest Specialist, Arizona State Land Department, for their input to this report.

CONDITIONS IN BRIEF

In the Southwest, total acres of bark beetle-killed trees increased from 66,350 acres in 1990 to 107,620 acres in 1991. Within the ponderosa pine forest cover type, western pine beetle and roundheaded pine beetle activity increased dramatically, causing a large majority of the volume loss (8,917,550 cubic feet), followed by Ips engraver beetle (539,280 cubic feet), and mountain pine beetle (143,250 cubic feet). Ips engraver beetles also caused an estimated volume loss of 6,000 cubic feet within the pinyon-juniper forest cover type. This is less than the volume loss in 1990 (1,140,000 cubic feet). In the mixed conifer and spruce-fir forest cover types, Douglas-fir beetle and true fir beetle attacks caused an estimated 168,250 and 177,600 cubic feet of volume loss and spruce beetle, 42,750 cubic feet of volume loss.

Defoliator activity Regionwide decreased from 314,250 acres in 1990 to 247,760 acres in 1991. Most of this defoliation was due to the western spruce budworm which defoliated an estimated 218,610 acres of the mixed conifer forest cover type. Aspen defoliation resulting from an insect and disease complex composed of the large aspen tortrix, western tent caterpillar, and Marssonina leaf blight, increased from 3,670 acres in 1990 to 29,150 acres in 1991.

Dwarf mistletoe infection continued to be the primary cause of growth loss, excluding densely stocked stands, in both mixed conifer and ponderosa pine forests.

Root and butt rots are another important group of diseases in the Southwestern Region. They contribute to total volume loss, create hazard trees in campgrounds and along roadways, and increase snag densities for wildlife. The most common root rots in the Region are Armillaria sp. and Heterobasidion annosum. They occur primarily in mixed conifer and spruce fir cover types.

White pine blister rust has now been detected throughout the range of southwestern white pine on three Ranger Districts of the Lincoln National Forest and on the Mescalero Apache Indian Reservation in New Mexico.

STATUS OF MAJOR INSECTS

Douglas-fir beetle, Dendroctonus pseudotsugae

Douglas-fir beetle activity increased Regionwide from a total of 700 acres in 1990 to 2,780 acres in 1991. Both individual and small tree group mortality (2 to 10 trees) occurred on the Apache-Sitgreaves, Coconino, Coronado, and Tonto National Forests and in some high elevation areas of the Saguaro National Monument in Arizona. The Carson, Lincoln and Santa Fe National Forests and Taos Pueblo Indian Reservation and Navajo Indian Reservation had similar mortality. Douglas-fir beetle populations remained high on State and private lands in Colfax County, New Mexico. Losses resulting from Douglas-fir beetle attacks in 1991 approximated 168,250 cubic feet of volume Regionwide.

Mountain pine beetle, Dendroctonus ponderosae

Acres of mountain pine beetle-caused ponderosa pine mortality increased from 800 acres in 1990 to 1,440 acres in 1991. Individual and scattered small group tree mortality (2 to 10 trees) were observed on the Santa Fe National Forest and the Navajo Indian Reservation, New Mexico. Mountain pine beetle has all but disappeared from chronic infestations in the Moreno Valley and Vermejo Park, New Mexico. Volume losses resulting from these bark beetles were estimated at 143,250 cubic feet Southwest-wide.

Pine engraver beetles, Ips spp.

Ponderosa pine mortality resulting from pine engraver beetle attacks decreased from 31,420 acres in 1990 to 11,030 acres in 1991. Individual, small group mortality (2 to 10 trees), and occasional large group tree mortality (25 trees and larger) occurred on the Apache-Sitgreaves, Coconino, Kaibab, Prescott, and Tonto National Forests and the Navajo, Hualapai, Fort Apache, and San Carlos Indian Reservations in Arizona and the Cibola, Gila, Lincoln, and Santa Fe National Forests and Mescalero Apache and Navajo Indian Reservations in New Mexico. On State and private lands in Arizona, pockets of Ips beetle-caused mortality were found near Flagstaff and Williams. Ips activity decreased in the Hualapai Mountains, and at Prescott, Heber, and Show Low. On State and private lands in New Mexico, Ips activity has continued in northern Rio Arriba County.

Ips-caused pinyon pine mortality decreased from 22,800 acres in 1990 to 620 acres on the pinyon-juniper forest cover type in 1991. Small group tree mortality occured on the Apache-Sitgreaves and Coconino National Forests and the Hualapai Indian Reservation in Arizona. Engraver beetles have caused extensive pockets of pinyon mortality on over 2,000 acres of the Pittsburgh Coal Mine a few miles east of Window Rock Arizona.

Tree volume losses from these bark beetles were estimated at 539,280 cubic feet for ponderosa pine and 6,400 cubic feet for pinyon pine.

Western pine beetle, Dendroctonus brevicomis and roundheaded pine beetle, Dendroctonus adjunctus

Mortality from western pine beetle increased from 9,015 acres in 1990 to 91,320 acres in 1991. The majority of the mortality detected this year occurred in combination with roundheaded pine beetle and was located on the Mescalero Apache Indian Reservation (71,785 acres) and the Lincoln National Forest (10,135 acres) in New Mexico.

Less extensive acreages of western pine beetle-caused mortality also occurred on the Tonto, Coconino, Coronado, and Kaibab National Forests and Navajo, Fort Apache, and San Carlos Indian Reservations in Arizona and the Carson, Cibola, and Gila National Forests and the Picuris Peublo Indian Reservation in New Mexico. Western pine beetle numbers have increased in New Mexico's southern forests. Tree volume losses on National Forests and other Federal lands were estimated at 8,917,550 cubic feet.

Spruce beetle, Dendroctonus rufipennis

Total acres of spruce beetle-caused tree mortality increased from 150 acres in 1990 to 430 acres in 1991. Individual tree mortality and small group tree mortality (2 to 5 trees) was widely scattered throughout the spruce forest cover type. Mortality occurred on the Coconino, Coronado, and Kaibab National Forests and the Navajo and Fort Apache Indian Reservations in Arizona. Scattered spruce beetle activity was detected on State and private lands near Tierra Amarilla and Sandoval County, New Mexico. Current year's volume losses from spruce beetle attacks approximated 42,750 cubic feet.

Western spruce budworm, Choristoneura occidentalis

Defoliation caused by the larvae of western spruce budworm decreased from 310,580 acres in 1990 to 218,610 acres in 1991. Defoliation occurred on the Carson (129,320 acres), Santa Fe (41,080 acres), Cibola (6,880 acres), Gila (2,640 acres), and Lincoln (300 acres) National Forests, and the Santa Clara Pueblo (3,640 acres), Navajo (200 acres) Indian Reservations in New Mexico. Defoliation occurred on 33,910 acres of State and private land in Colfax, Mora, Rio Arriba, Sandoval, and Taos Counties in New Mexico. Scattered light defoliation was detected from the ground in the mixed conifer type on the Kaibab and Apache-Sitgreaves National Forests in Arizona.

Table 1. Acres of Western Spruce Budworm Defoliation, Southwestern Region, 1991

Land Ownership Class	Defoliation (Acres) Light	Moderate	Heavy	Total
National Forest	52,720	96,220	31,280	180,220
Indian Lands	800	3,680	0	4,480
National Park Service	0	0	0	0
State and Private*	20,333	11,940	1,640	33,910
		GRAND TOTAL		218,610

* Intermingled State and private within and adjoining National Forests

Table 2. Status of Other Insects Occurring in Arizona and New Mexico in 1991.

Insect	Host	Location	Remarks
Douglas-fir tussock moth *Orgyia pseudotsugata*	Douglas-fir White fir Spruce	New Mexico	High levels of tussock moth defoliation continued in the communities of Santa Fe, Los Alamos, and White Rock where some top-killing and mortality of host trees were reported. Low levels of tussock moth activity were also reported in Espanola, Cedar Crest, Raton, and Ruidoso.
Fall webworm *Hyphantria cunea*	Siberian elms Cottonwoods	New Mexico	Fall webworm populations remained at high levels in northern New Mexico. Siberian elms and cottonwoods were heavily defoliated by these insects in the city of Grants.
Pandora moth *Coloradia pandora*	Ponderosa pine	Arizona	No pandora moth defoliation was detected in 1991.
Pinyon needleminer *Coleotechnites edulicola*	Pinyon pine	New Mexico	Small pockets of pinyon needleminer damage were detected on woodland pinyons east of Santa Fe where approximately 500 acres were infested.
Pine tip moths *Rhyaciona* spp.	Ponderosa pine	New Mexico	Southwestern pine tip moth and an unidentified, later emerging tip moth species caused some damage to a plantation near Mora. Southwestern pine tip moth also damaged some landscape pines in communities over 6,500 feet. Nantucket pine tip moth feeding activity seriously deformed young landscape pines in Albuquerque and southern New Mexico.
Pine sawflies *Zadiprion* spp. *Neodiprion* spp.	Ponderosa pine	New Mexico	Ponderosa pine sawfly defoliation was detected along the east side of the Sangre de Cristo Mountains from Storrie Lake State Park to Sapello. Winter feeding of *Z. townsendi* was reported in several locations around Santa Fe. Pinyon sawflies defoliated a Tucumcari windbreak south of Santa Fe along Highway 14.

Table 2. Status of Other Insects Occurring in Arizona and New Mexico in 1991 continued.

Insect	Host	Location	Remarks
Pinyon needle scale *Matsucoccus acalyptus*	Pinyon pine	Arizona New Mexico	Pinyon needle scale populations increased in pinyon woodlands and on ornamental pinyons Regionwide. In Arizona, a large infestation continued near Prescott. In New Mexico, outbreaks detected include those found north of Carrizozo (300 acres) south and east of Silver City (500 acres), and southwest of Socorro. Pinyon needle scale defoliation also continued to occur between El Rito and Ojo Caliente (150 acres) in Rio Arriba County and 15 miles south of Willard in Torrance County. Damages to landscape pinyons in urban areas appeared to be up statewide.
Ponderosa pine needleminer *Coleothechnites ponderosae*	Ponderosa pine	New Mexico	Ponderosa pine needleminer damage was detected on 500 acres of State and private lands in Miguel County near Minneral Hill. This is a decrease from the 7,220 acres effected in 1990. The main infestation has shifted north towards Mora. Needleminer damages also continued to occur around Los Alamos.
Prescott Scale *Matsucoccus vexillorum*	Ponderosa pine	Arizona	Branch dieback, caused by Prescott Scale, was scattered throughout the Region during 1991. Approximately 700 acres are still infested by this scale insect on the Fort Apache Indian Reservation and areas of the Apache-Sitgreaves National Forest are affected as well.
Twig beetles *Pityophthorus* spp.	Pinyon pine	New Mexico	Extensive woodland tree mortality was not seen this year. Populations remained high in stressed landscape pines. Twig beetles continued to be the main cause of balled and burlapped pinyon and ponderosa pine mortality.

Table 2. Status of Other Insects Occurring in Arizona and New Mexico in 1991 continued.

Insect	Host	Location	Remarks
Spruce aphid *Elatobium* sp.	Spruce	Arizona New Mexico	Spruce aphid populations were low on ornamental spruce.
PEST COMPLEXES			
Aspen defoliation			
Large aspen tortrix *Choristoneura conflictana* Western tent caterpillar *Malacosoma californicum* Marssonina blight *Marssonina populi*	Aspen	Arizona New Mexico	Defoliation of aspen stands by this insect and disease complex increased Regionwide from 3,670 acres in 1990 to 29,140 acres in 1991. Small pockets of aspen defoliation occurred on the Apache-Sitgreaves and Coconino National Forests and the Fort Apache Indian Reservation, Arizona and the Carson, Cibola, Gila, Lincoln, and Santa Fe National Forests, and the Mescalero Apache and Navajo Indian Reservations, New Mexico. Western tent caterpillar was found to be the primary defoliator on State and private lands east of Santa Fe, and in scattered stands between Black Lakes and White's Peak. Aerial surveys detected 4,000 acres of aspen defoliation on State and private lands in New Mexico.
True Fir Mortality *Scolytus ventralis* (in white fir); *Dryocetes confusus* (in subalpine fir) *Armillaria* spp. *Heterobasidion annosum*	White Fir Subalpine fir	Arizona, New Mexico	True fir mortality resulting from this insect and disease complex increased from 1,390 acres in 1990 to 2,495 acres in 1991. Mortality consisted of individual and small (2 to 10 trees) group tree-killing on the Coconino and Coronado National Forests and Navajo Indian Reservation, Arizona, and the Cibola, Gila, Lincoln, and Santa Fe National Forests, and the Mescalero Apache and Navajo Indian Reservations, New Mexico. Volume losses attributed to this insect and disease complex approximated 177,600 cubic feet.

STATUS OF MAJOR DISEASES

Dwarf mistletoes, Arceuthobium spp.

Dwarf mistletoes are the most widespread disease-causing agents in the Southwestern Region. Effects of dwarf mistletoe infection include: growth loss; mortality; reduced cone and seed production; reduced seed viability; food for wildlife; and wildlife habitat. Estimated annual volume loss in infected ponderosa pine forests is over 25 million cubic feet on all Federal lands. Tree decline and mortality caused by these parasites increases hazard to people and their property in campgrounds, but may increase or decrease aesthetic quality in visual corridors. Dwarf mistletoes are beneficial to some wildlife species. Many birds and mammals consume the shoots of mistletoe and nest in dense witches' brooms. Dwarf mistletoes also lower the canopy of an infected area which may be favored by certain wildlife species. Dwarf mistletoes can also impart detrimental effects on wildlife habitat by reducing its longevity.

The most prevalent dwarf mistletoe species in Arizona and New Mexico is A. vaginatum subsp. cryptopodum on ponderosa pine, which is the most prevalent coniferous species in the Region. A. douglassii on Douglas-fir, A. microcarpum on Englemann and blue spruce, and A. divaricatum on pinyon pine are also abundant and damaging. Juniper species and cypress are infected by Phoradendron spp., or true mistletoes.

Although dwarf mistletoes are a natural part of the forest ecosystem, having evolved with their coniferous hosts for thousands of years, evidence suggests that their incidence has increased due to human activity. Suppression of wildfires and inappropriate harvesting practices have often contributed to an increase in the incidence of these parasites. Increasing levels of dwarf mistletoe infection in the Region point out the need for and importance of well conceived efforts to control these parasites. Forest Pest Management provides both financial and technical assistance for projects designed to reduce the level of infection in established stands, to protect young regeneration from infection, and to replace some heavily infected stands. Projects designed with multi-resource objectives such as projects to increase vigor and longevity of trees in recreation areas and visual corridors or improve wildlife habitat are encouraged.

Root diseases

Root and butt rot pathogens are responsible for approximately 10 percent of the conifer mortality Regionwide. Infections in some mixed conifer stands are greater than 25 percent. Armillaria spp. account for 80 percent of the root disease in conifers. Other root pathogens include Fomes annosus, Phaeolus schweinitzii, and Inonotus tomentosus, the latter occurring on spruce. Since the majority of root disease occurs in mixed conifer forests, many of which are either designated as Wilderness or are inoperable, timber production is not greatly affected. However, many campgrounds were developed in mixed conifer forests and root disease contributes significantly to the development of hazard trees. Surveys designed to map root disease are helpful as a guide to selecting placement of a proposed campground facility.

White pine blister rust

We have now detected blister rust throughout most of the range of southwestern white pine (Pinus strobiformis) in the Sacramento Mountain area of southern New Mexico. The affected area includes about 300,000 acres of mixed-conifer forest on the Lincoln National Forest and the Mescalero Apache Indian Reservation. The most severely infected areas are on the Cloudcroft Ranger District. Branch mortality ("flagging") is abundant, and top-kill and mortality of young trees is occurring where the disease is well established.

Southwestern white pine is proving to be very susceptible to this non-native fungal disease. In addition, the summer rainy season of the Southwest is probably very favorable to development and spread of the fungus. The southwestern white pine population of the Sacramento Mountains, which is the largest in the United States, will probably be severely impacted during the next several decades.

So far, we have not detected blister rust in other parts of the Region. Hopefully, the isolated nature of our mountain ranges will limit or prevent its further spread, although spread by means of spores in the upper atmosphere is possible. It is also possible that humans could spread this disease by transplanting white pines or Ribes, the alternate host, from infected areas. The New Mexico Department of Agriculture, Lincoln National Forest, and Mescalero Agency are cooperating to reduce the likelihood of disease spread.

Melampsora rust

The Apache-Sitgreaves National Forest and the Fort Apache Indian Reservation expressed concern that a species of Melampsora rust is threatening the existence of arizona willow, a sensitive species proposed for listing as being threatened and endangered. A survey will begin in 1992 to assess the occurrence and impacts of the rust on Arizona willow and other species of willow in affected areas. There are many Melampsora spp. which occur on willows, all having separate alternate hosts. It is difficult to identify these rusts to the species level because the spore stage which occurs on the willow looks identical for all species.

Table 3. Southwestern Region--Status of Other Diseases in Arizona and New Mexico

Disease	Host	Location	Remarks
STEM AND BRANCH DISEASES			
Red rot *Dichomitus squalens*	Ponderosa pine	Arizona, New Mexico	Red rot decay is distributed throughout the Region and is the most common cause of decay in living ponderosa pine in the Southwest.
Red ring rot *Phellinus pini*	Douglas-fir, Ponderosa pine, Spruce, True firs	Arizona, New Mexico	*Phellinus pini* is indigenous to mature and overmature stands of pine and mixed conifers. Its distribution is scattered and losses and damages are minimal in most stands.
Rust-red stringy rot *Echinodontium tinctorium*	White Fir	Arizona, New Mexico	This fungus is found in mature and overmature stands of mixed conifers.
Aspen trunk rot *Phellinus tremulae*	Aspen	Arizona, New Mexico	Aspen trunk rot is the most common cause of decay in mature aspen stands throughout the Region.
Atropellis canker *Atropellis* spp.	Southwestern White Pine	New Mexico	Stem cankers were found on pole-size trees on the Lincoln National Forest and Mescalero Apache Indian Reservation. Branch flagging is also common and could be mistaken for white pine blister rust.
Aspen stem cankers *Encoelia pruinosa* *Ceratocystis fimbriata* *Cryptosphaeria populina* *Hypoxylon mammatum* *Cytospora chrysosperma*	Aspen	Arizona, New Mexico	These canker fungi cause significant reductions in growth and vigor of mature aspen stands. In Region 3, stands often have over 30 percent infection with canker fungi. In campgrounds, stem cankers are typically more prevalent due to damage from campers.
Spruce broom rust *Chrysomyxa arctostaphyli*	Spruce	Arizona, New Mexico	Spruce broom rust is scattered throughout the host type but is of little commercial significance.
Comandra blister rust *Cronartium comandrae*	Mondell pine, Ponderosa pine	Arizona	Comandra blister rust was reported for the first time on ponderosa pine in the Lakeside area in Arizona.

Table 3. Southwestern Region--Status of Other Diseases in Arizona and New Mexico--Continued

Disease	Host	Location	Remarks
Fir broom rust *Melampsorella caryophyllacearum*	True firs	Arizona New Mexico	Fir broom rust is widely distributed throughout the subalpine, corkbark, and white fir habitat types in the Southwest. Damages typically consist of stem and branch swellings, dead tops, and stem breakage.
Limb rust *Cronartium arizonicum* *Peridermium filamentosum*	Ponderosa pine	Arizona	Small group (2 to 3 trees) infections are located throughout the ponderosa pine forests of the Southwest.
ROOT DISEASES			
Black stain root disease *Leptographium wageneri* var. *wageneri*	Pinyon pine	Arizona, New Mexico	In addition to the root rot fungi listed above, root disease pockets caused by these organisms are small and scattered throughout the Region.
White mottled rot *Ganoderma applanatum*	Aspen	Arizona, New Mexico	
FOLIAGE DISEASES			
Elytroderma disease *Elytroderma deformans*	Pinyon pine, Ponderosa pine	Arizona, New Mexico	Elytroderma disease is widely distributed but at low levels.
Lophodermella cerina	Ponderosa Pine	Arizona, New Mexico	In 1991 this needle cast was only detected in New Mexico. Approximately 18,000 acres exhibited mostly low to moderate levels of discoloration.

Table 3. Southwestern Region--Status of Other Diseases in Arizona and New Mexico--Continued

Disease	Host	Location	Remarks
ABIOTIC			
Drought	Ponderosa pine Pinyon Juniper	Arizona, New Mexico	Drought related tree damage was significantly lower Region-wide than in 1990. However, drought stressed trees were attacked by bark beetles over a large areas on the Lincoln National Forest and Mescalero Apache Indian Reservation in New Mexico.
Salt damage	Ponderosa pine	New Mexico Arizona	Needle discoloration occurred along high elevations in New Mexico and Arizona from salt used to deice highways. Salt damage was also observed on dirt roads in Arizona where salts were used for dust abatement.
Winter Injury	Alligator juniper	Arizona	Needle discoloration and top dieback of small diameter alligator juniper was observed on the Heber, Lakeside, Springerville, and Alpine Ranger Districts of the Apache-Sitgreaves National Forest. The alligator juniper was at the upper extent of its range in these areas and had been affected by the cold winter temperatures the area received in December.

FOREST PEST MANAGEMENT ACTIVITIES IN 1991

Training

One of this year's highlights was our Region-wide training session, "Management of Forest Pests Through Silviculture" in Taos, New Mexico in September. Staff members from both the Arizona and New Mexico Zones gave presentations on insects and diseases of forest trees of the Southwest, with emphasis on biology and control. A panel discussion on forest health featured Forest Service speakers representing silviculture and wildlife, as well as, representatives from New Mexico State Game and Fish Department and Forest Watch. Field trips gave participants opportunities for group interaction and application of ideas. The session was well attended and well received. A similar session will be held on the North Kaibab Ranger District, Kaibab National Forest in September 1992.

A session designed specifically for the management of insects and disease and hazard trees in recreation areas was held in Flagstaff in April 1991. In addition to recreation managers of the Forest Service throughout the Region, this session was also attended by employees of Grand Canyon National Park.

One day insect and disease recognition sessions were conducted at various districts to help survey and marking crews recognize and adequately assess insects and diseases. Particular attention was given to properly rating dwarf mistletoe infection.

Aerial detection surveys

On over 9.4 million acres of Federal lands in Arizona and New Mexico were surveyed from July thru mid September. Forest Pest Management surveys nearly all forested areas of the Region (except pinyon-juniper woodlands) annually. Other areas, including pinyon-juniper woodlands, are flown on request. Ground examinations are often made to confirm aerial observations. Upon completion of the surveys, maps showing the type, location, and extent of outbreaks are prepared and sent to the respective administrative units. Aerial surveys are an effective way to detect activity of several major forest pests. Done annually, they provide an excellent way to monitor changes in pest activity over time. State pest management specialists conduct aerial and ground surveys on State and private lands.

Detection kits

A wide variety of insects and diseases were identified by our staff from surveillance reports sent by forest workers from across the Region. Such reports are important for the early detection of potential pest problems, and land managers and forest workers are encouraged to continue prompt reporting of any unusual insect and disease activity. Detection kits containing vials and bags for specimens, along with a surveillance work sheet, are provided by Forest Pest Management.

Integrated resource management

Forest Pest Management Specialists provided expertise and assistance to interdisciplinary planning teams throughout the Region. In Arizona, Forest

Pest Management consultants worked on a number of projects, primarily timber sales, on the Apache-Sitgreaves, Coconino, Kaibab, and Tonto National Forests. Forest Pest Management consultants assisted interdisciplinary team members in evaluating insect and disease conditions within planning areas and assessing how those conditions may affect accomplishment of future management objectives. The `Management Recommendations for the Northern Goshawk in the Southwestern United States' report was reviewed and comments on pest implications of management for goshawk were contributed to the Integrated Management review team.

Snag recruitment

Over the years, several of our dwarf mistletoe control projects have included recruitment of infected overstory trees for potential wildlife snags. The most commonly used method has been girdling with a chainsaw and/or axe. This method is relatively easy and inexpensive, but girdled trees have often remained alive for several years, and many of them have broken off at or near the girdle. Recent projects on the Luna Ranger District in New Mexico have used fire as a "recruitment method." Slash is piled around the base of the tree to provide a hot enough fire to consume the bark around the lower bole. This method usually kills trees within a year or so, and may reduce the chance for breakage. We will continue to monitor these projects for snag longevity and wildlife use.

Establishment of permanent plots

Twelve permanent plots were established in ponderosa pine forests infected with southwestern dwarf mistletoe. These were established as part of the "Pest Trend Impact Plots in the West" project. The purpose of the project is to establish and monitor permanent plots in areas affected by specific insects or diseases and use the information to validate the pest subroutines of the Prognosis growth and yield model. These plots range from 0.5-2.5 acres in size and vary in density, vertical structure, dwarf mistletoe infection level, and other site conditions. They were placed in forested stands which would be deferred from activity for at least the next 10 years. This included stands designated for old growth, research, and Goshawk post-fledgling areas. The established plots will be revisited every 2 years.

Table 4. Dwarf Mistletoe Presuppression Surveys and Suppression Projects Conducted During 1991 on National Forest and Bureau of Indian Affairs Trust Lands.

Federal Agency	Presuppression Survey Acres	Suppression Project Acres
National Forest		
Apache-Sitgreaves		100
Carson	4,900	100
Coconino	6,000	105
Kaibab		100
Lincoln	200	20
Prescott	300	
Santa Fe	10,000	131
Tonto	10,000	1,500
Reservation		
Fort Apache	20,000	
Jicarilla		175
Mescalero		649
San Carlos	3,700	450
Santa Clara	600	22
Ramah Navajo		40
TOTALS	55,700	3,392

BIOLOGICAL EVALUATIONS COMPLETED IN 1991

Arizona Zone

1. First Year Post-treatment Biological Evaluation of the Pumkin Dwarf Mistletoe Suppression Project, Kaibab National Forest (NF). January 91.

2. Biological Evaluation for the Canyon Point Campground Dwarf Mistletoe Suppression Project. Apache-Sitgreaves National Forest. April 91.

3. Biological Evaluation of the Proposed 1992 Wildhorse Dwarf Mistletoe Suppression Project, Fort Apache Indian Reservation. May 91.

4. Biological Evaluation of the Forty-Four Dwarf Mistletoe Suppression Project, Long Valley Ranger District (RD), Coconino National Forest (NF). June 91.

5. Biological Evaluation of the Moritz and Kaufman Dwarf Mistletoe Control Projects, Chalender Ranger District. June 91.

6. Post-treatment (1-year) Biological Evaluation of the 1989 May Dwarf Mistletoe Control Project. Kaibab National Forest. June 91.

7. Post-burn Evaluation (1 year) of the 1990 Meads Dwarf Mistletoe Suppression Project. August 1991.

8. First year Post-treatment Biological Evaluation of the Arizona Trail Dwarf Mistletoe Interpretive Area. Kaibab National Forest. August 91.

9. Pre-treatment Biological Evaluation of the Crouch and Ashmo Dwarf Mistletoe Suppression Projects. Tonto National Forest. September 91.

10. Functional assistance trip to the Schoolhouse Analysis Area of the Prescott National Forest. 1/25/91.

11. Functional assistance trip to existing and proposed campgrounds on the Alpine Ranger District, Apache-Sitgreaves National Forest. June 1991.

12. Functional assistance trip to Phantom Ranch, Bright Angel Campground, and Indian Gardens of the Grand Canyon National Park. June 1991.

13. Functional assistance trip to the North Kaibab Ranger District, Arizona. 11/7/91.

14. Functional assistance trip to Fort Apache Indian Reservation regarding Prescott scale and spruce aphid. 9/19/91

15. Functional assistance to Kendrick 10K Assessment, Peaks RD, Coconino National Forest. 8/29/91.

16. Functional assistance to Maverick New Perspectives Project, Bradshaw Ranger District, Prescott National Forest. 10/24/91.

NEW MEXICO

1. Stand 100 dwarf mistletoe control project, Espanola Ranger District. Santa Fe National Forest. 2/1/91.

2. Conifer damages at Cochiti Lake Visitor center, Sandoval County, New Mexico. 2/19/91.

3. Pescado Woodland's Project area, Zuni Pueblo Indian Reservation. 2/19/91.

4. Bark Beetles in Cloudcountry West Subdivision, Cloudcroft, New Mexico. 3/11/91.

5. White pine blister rust, Lincoln National Forest. 5/16/91.

6. Discolored pinyon pines, Navajo Indian Reservation. 5/29/91.

7. Hazard trees in proposed Jemez Corridor recreation sites, Jemez Ranger District, Santa Fe National Forest. 6/21/91.

8. Valle Vidal dwarf mistletoe control project, Questa Ranger District, Carson National Forest. 6/24/91.

9. Discolored pinyon pines, Picuris Pueblo. 6/25/91.

10. Cottonwoods at Quarai Contact Station, Salinas National Monument. 6/25/91.

11. Cerro Alto timber, Ramah Navajo Indian Reservation. 6/28/91.

12. Dike Rock dwarf mistletoe control project, Jicarilla Apache Indian Reservation. 7/24/91.

13. Proposed Aqua Piedra and Hopewell Lake Campground expansion areas, Carson National Forest. 7/29/91.

14. Bark beetle activity, Mescalero Apache Indian Reservation. 8/5/91.

15. Post-treatment evaluation, Whitetail 1 and 2 dwarf mistletoe control projects, Mescalero Apache Indian Reservation. 8/12/91.

16. Los Cerros dwarf mistletoe control project, Espanola Ranger District, Santa Fe National Forest. 8/23/91.

17. Taos Pueblo forest health evaluation. 8/29/91.

18. Ethephon spray trials, Los Alamos, New Mexico. 9/18/91.

19. Dwarf mistletoe control project, Camino Real Ranger District, Carson National Forest. 9/20/91.

20. Dwarf mistletoe control projects, Mescalero Apache Indian Reservation. 9/23/91.

21. Westside dwarf mistletoe control project, Cloudcroft Ranger District, Lincoln National Forest. 9/25/91.

22. Valle Grande burn, El Rito Ranger District, Carson National Forest. 9/26/91.

23. Deer Pond dwarf mistletoe control project, Santa Clara Indian Reservation. 10/2/91.

24. Western spruce budworm egg mass survey, Camino Real Ranger District, Carson National Forest. 10/3/91.

25. Post-treatment evaluation, Benji/Jarito Mesa dwarf mistletoe control project, El Rito Ranger District, Carson National Forest. 10/24/91.

26. Dwarf mistletoe control project, Pecos Ranger District, Santa Fe National Forest. 12/9/91.

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